The Examiner requests, that we amend the claims to include structures of formulae (I), (II) and (III), to define more precisely the structures to which the term "end group" refers and to clarify the term "organic compounds" in claim 3.

Amendments of claims 1 and 3 solve the indefiniteness problem of claims 1-15.

Claim Rejections – 35 USC §102

The Examiner rejects claims 1-9 as being anticipated by of Chen et al. (US 5,837,799). Applicant respectfully traverses that rejection.

Regarding claims 1-3, we note as follows:

The instant application and US 5,837,799 deal with flame retarding (FR) of polymers comprising halogenated compounds, wherein said compounds, are based on bisphenol A and comprise brominated epoxides (BEs) modified with tribromophenol (TBP). The flame retardant of the invention is bisphenol A based, highly end-capped (more than 80%) high molecular weight (7,000 – 50,000 Dalton) BEs, with low content of volatiles, for flame retarding of engineering thermoplastics.

In US 5,837,799, table 1, reference example 4 is TB-62, a commercially available modified brominated epoxy oligomer. According to the manufacturer (Tohto Kasei), the TB series are highly brominated resins, structured around a TBA. However, in contrast to the claimed compounds, TB-62 displays a low softening point (111-120°C) and a low molecular weight of around 1,800-2,300 Dalton. Moreover, as Chen et al. neither disclose precisely the procedure to obtain TB-62 (col. 6, lines 36-40), nor indicate the concentration of free TBA or organic solvent within the product, no comparison can be done on these points with the compounds of the present invention.

When low molecular weight BEs are used, inferior behavior was observed comprising significantly lower melt flow, and higher adhesion of the polymer composition, which limits the processability. The high metal adhesion of the engineering thermoplastic flame retarded is problematic, for example when the thermoplastic is recycled. Moreover, low molecular weights BEs are difficult to process (last paragraph on page 5). As described in the specification (e.g., page 5) the invention provides a composition that is well flowing, having lower viscosity, having lower adhesion, and are more heat stable. Furthermore, the flow rate of the instant composition even increases with time during processing at high temperatures, in contrast to the prior art materials (e.g., lines 15-28 on page 5, and melt flow indexes after 5 and 30 minutes in Table II). What is also surprising is that the instant compositions (with high molecular weight retardants) have higher flow rate even when compared with compositions retarded with low molecular weight BEs. The low content of residual volatiles in the engineering thermoplastics further improves performance of the compositions, lowering the corrosion of metallic parts in contact with the compositions (lines 8-10 on page 3), e.g. in electrical application, according to the Inventors' experience.

A copy of the page displaying properties of TB-62, available in the manufacturer website, is enclosed for Examiner's kind attention.

Therefore, claim 1 is believed to be novel, as well as claims 2-3 and all claims depending on claim 1, in particular claims 2-9.

Regarding claim 4, it is noted:

In US 5,837,799, table 1, reference example 4 is TB-62, a commercially available modified brominated epoxy oligomer. According to the manufacturer (Tohto Kasei), the

TB series are highly brominated resins, structured around a TBA. However, in contrast to the claimed compounds, TB-62 displays a low softening point (111-120°C) and a low molecular weight of around 1,800-2,300 Dalton. Again, as mentioned above, Chen et al. neither disclose precisely the procedure to obtain TB-62 (col. 6, lines 36-40), nor indicate the concentration of free TBA or organic solvent within the product, no comparison can be done on these points with the compounds of the present invention.

Regarding claims 5 and 6, we note the following:

The reference US 5,837,799 claims the polymerization degree of 0 to 30 (col. 4 lines 58-59), and exemplifies BEs having a softening point of 108-112°C (Table 1). Said polymerization degree (n) corresponds to a molecular weight of between 0 and 18,000 (when considering a monomer of MW of about 600), and said softening point corresponds to molecular weight of below 2,000 Dalton (n about 3 to 4). Molecular weight, calculated from the exemplified softening point and expressed as n, thus, falls into the claimed molecular weight range, but the fact that no explicit MW values are presented in that context, and that only low molecular weight BEs were used, clearly shows that no attention was paid to the need of high molecular weight in the reference, and its importance remained unrecognized.

Further, the product of this reference is only partly end-capped, exhibiting about 40-65% end-capping (see, e.g. claim 1). Therefore, the product would not be generally suitable for engineering thermoplastics, for example in polyamides it would cause gelation, in contrast to the instant product.

Regarding claims 7-9 we note:

Fire retardant agent described in Chen's patent has acid numbers above 1 mg KOH/g; there may be phenols present (tetrabromobisphenol A and tribromophenol). Further, Chen will have an epoxy equivalent lower than 10,000, as they have lower molecular weight. Nevertheless, claims 7-9 depend from claim 1, which is now believed to be novel.

The Examiner rejects claims 10 and 12 as being anticipated by Chen et al. (US 5,837,799). Applicant respectfully traverses that rejection.

Regarding claim 10 we note:

US 5,837,799 deals with flame retarding (FR) of polymeric compositions comprising halogenated compounds, wherein said compounds, are based on bisphenol A and comprise brominated epoxides (BEs) modified with tribromophenol (TBP). Said polymeric compositions also comprise a thermoplastic resin that may be for example PET/polyethylene teraphtalate, PBT/polybutylene teraphtalate, polycarbonate resin or polyamide resin. However US 5,837,799 never mentions polymeric compositions comprising one of the above-mentioned thermoplastic resin and a fire retardant based on bisphenol A, highly end-capped (more than 80%), with a high molecular weight (7,000 – 50,000 Dalton) BEs, and a low content of volatiles.

Regarding claim 11 we note:

Use of filler, lubricant and pigments as additives in fire retarded thermoplastic resins is well known by any person skill in the art. As US 5,837,799 neither claims high molecular weights, highly end-capped BEs, with low content of volatiles, for use as fire retardants, nor use such fire retardants in polymeric compositions, then adding said additives to fire retarded polymeric compositions of the present inventions can be considered as novel in view of the cited publication.

Furthermore, as claims 10 and 12 depend on claim 1, which is believed to be novel, claims 10 and 12 should be novel too.

The Examiner rejects claims 13 and 14 as being anticipated by Chen et al. (US 5,837,799). Applicant respectfully traverses this rejection.

The instant application and US 5,837,799 deal with flame retarding (FR) of polymers comprising halogenated compounds, wherein said compounds, are based on bisphenol A and comprise brominated epoxides (BEs) modified with tribromophenol (TBP). The flame retardant of the invention is bisphenol A based, highly end-capped (more than 80%) high molecular weight (7,000 – 50,000 Dalton) BEs, with low content of volatiles, for flame retarding of engineering thermoplastics.

US 5,837,799 mentions a highly end-capped fire retardant (TB-62, Table1 Ref. 4), but the authors do not disclose the method of producing it. Since this compound belongs to the same company as the patent assignee, the Inventors presume that the authors of US 5,837,799 have based their comparison on internal data. One of the methods disclosed in US 5,837,799 for producing fire retardants comprises the steps of reacting low molecular weight brominated epoxide (LMW-BE), tetrabromo bisphenol type A (TBA) type expoxy resin with TBA and tribromophenol (TBP) or tribromo phenyl glycydil ether in the presence of a catalyst. However, the method does not mention the use of LMW-BE with low volatile content, and enable to obtain only poorly end-capped, low molecular weight compounds.

Furthermore, as claim 13 depends on claim 1, which is believed to be novel, as explained above, claim 13 is also believed to be novel.

Claim 15 was canceled.

Claim Rejections – 35 USC §103

The Examiner rejects claim 11 as being unpatentable over Chen et al. (US 5,837,799) as applied to claim 10 above in view of Chisholm et al. (US 2001/0009944). The Examiner further rejects claim 15 as being unpatentable over Chen et al. (US 5,837,799) as applied to claim 13 above when taken with Nantaku et al. (JP 2001-310990). Nevertheless, as explained below, the cited documents do not lead a skilled person to the instant invention.

US 5,837,799 deal with flame retarding (FR) of polymers comprising halogenated compounds, wherein said compounds, are based on bisphenol A and comprise brominated epoxides (BEs) modified with tribromophenol (TBP). Flame retardants disclosed by Chen et al. are bisphenol A based, poorly end-capped (40-65%), low molecular weight (around 2,000 Dalton) BEs.

According to the translation provided, the synthesis of the product in Nantaku et al. was conducted in dioxane, and the solvent was removed by heating in a vacuum dryer. In view of high excess of the solvent used in this procedure, it would be very difficult to obtain a product with a low solvent content in this manner (as demonstrated in instant Example 3), even if such a goal was set, however, the importance of low volatiles was not realized. Further, Nantaku et al.does not recognize the advantage of highly end capped product over partially end-capped and non-end-capped product.

Chisholm et al. discloses a thermoplastic resin composition comprising alkylene aryl polyester having metal sulfonate units (abstract) and mentions brominated flame retardant based on brominated polycarbonate only incidentally (Tables I and XI). US 2001/0009944 also mentions that additives can be added to thermoplastic resins such as

other resins, fillers, reinforcements, stabilizers, flame retardants and rubbery impact modifiers. The use of such additives in thermoplastic resins is well known for a person skilled in the art.

Non-obviousness of the claims

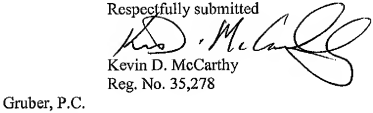
In view of the above, we note that:

- None of the cited references teaches the importance of high end-capping of TBP modified brominated epoxides based on bisphenol A, namely more than 80%.
- None of the cited references teaches the importance of high molecular weight of TBP modified brominated epoxides based on bisphenol A, namely a weight 7,000 – 50,000 Dalton.
- None of the cited references teaches the importance of low volatiles in TBP modified brominated epoxides based on bisphenol A, namely less than 100 ppm of organic solvents with Tb<250°C, and less than 0.1% TBP.
- None of the cited references teaches the use of TBP modified brominated epoxides based on bisphenol A specifically in engineering thermoplastics.

The above combination of features is nor arbitrary, but provides a retardant for engineering thermoplastics with superior properties during both processing and using. The advantages of the retardant of the invention are mentioned above. An example, showing unexpected features of the product according to the invention, is shown in Table II on page 12 of the instant specification, where a retardant according to the invention (F-3100LG) is compared with two uncapped materials (also brominated epoxides based on bisphenol A, high molecular weight); the melt flow index values show that the invention not only provides a superior material because the flow values are improved, but in addition to this, an unexpected phenomenon is observed – the instant materials increases the flow rate under processing conditions (higher rate at 30 minutes than at 5 minutes), while comparative materials remain the same or decrease the flow.

It is seen from the above explanation that the improved features of the material according to the invention are not inherent, and further it is evident that the above advantages of the instant retardant cannot be deduced from any of the cited documents or from any of their combination. Accordingly, this application is believed to be in condition for allowance and it is respectfully solicited that such allowance be granted.

Respectfully submitted



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